In starting out to write this paper I was thoroughly convinced that any departure from the classical terminology was to be deplored. Since examining and tabulating the classifications from various sources I am convinced that there is no need to sacrifice the advantages of an anatomical classification to this end. If we take three simple heads: (1) Crepitant or vesicular; (2) mucous or tube; and (3) cavernous we shall be able to place every rale we hear excepting pleuritic friction sounds, which are perhaps best excluded from this category.

It may be that I may be charged with perverting the meaning of the word "mucous." It is surely within a tube lined with mucous membrane that these rales have their origin. Whether fluid or tenacious, the basis of the mechanism which produces them is mucous; whether they are due to turgescence of the lining of the tube, or to muscular contraction in the wall, our term applies. We can utilize the classical *subcrepitant* and the onomatopoetic pair *sonorous* and *sibilant* as subdivisions of the *mucous*. Nearly all of the half a hundred of varieties described by the authors named and others would be subvarieties of the mucous rale.

Of the other two, one (*crepitant*) stands alone and needs no comment or word of explanation. The other (*cavernous*) I should perhaps include within the category of mucous rale also. This would be a further and a desirable simplification. We should then have but two categories: (1) Vesicular or crepitant rales; (2) tube or mucous rales. This shortening involves no departure from Laennec's form other than placing *sonorous* and *sibilant* as subheads of mucous and the addition of the corresponding anatomical words.

I feel sure that teachers and students would rejoice if but two great classes of rales were to be remembered.

THE DIAGNOSIS OF PRIMARY LUNG TUMORS.[1]

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Until comparatively recently the lungs have been an unexplored surgical domain. Improvement in method of anesthesia and in the technic of thoracic surgery have enabled the surgeon to invade the lungs with rapidly increasing success. The time is not far off when thoracic surgery will be just as common and the thorax invaded by the surgeon with the same ease as the abdomen is today. The development of this hitherto untrodden surgical field imposes upon the internist the duty of recognizing intrathoracic lesions that may be amenable to surgical treatment much earlier than was previously necessary or customary.

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[1] Read at a meeting of the Yorkville Medical Society, February 20, 1920.

We shall confine our remarks in this paper to the medical diseases of the lungs which are amenable to surgical treatment. Essentially such lesions consist almost entirely of lung tumors.

Tumors of the lungs may be either secondary or primary. We shall discuss the secondary tumors first as they are much more common and comparatively easy to recognize, but hopeless from the therapeutic standpoint. However, they are apropos in this discussion because their clinical features throw a good deal of light upon the primary lesions of the lungs. The diagnosis of these secondary metastases of the lungs does not present many problems. Nevertheless it is surprising how often the condition is overlooked. The most important diagnostic feature of the secondary metastatic lung tumors is, of course, the etiological factor. This is the history of a previous removal of a primary lesion, in the breast, in the stomach, in the eye or other organ; or, as is not infrequently the case, the actual but unrecognized presence of the primary lesion at the time the patients present themselves for examination.

Besides the history of this etiological factor the patient complains of progressive cough and expectoration, which may or may not be blood tinged, of dyspnea, cyanosis, pain in the chest and loss of weight. At the same time there may be symptoms of other metastases such as pains along the arm and forearm from axillary nodes or pain in the back and along the extremities as evidence of spinal metastases.

The examination of the chest may reveal areas of localized crepitant and subcrepitant rales or signs of fluid in one or both chests. The character of the fluid on aspiration is of extreme importance. A bloody fluid in the chest is very suggestive of metastasis in the lung, but the fluid does not become bloody unless the metastases are very extensive, and consequently the presence of a serous fluid in the chest does not exclude malignancy. The roentgenographic examination may show scattered shadows in one or both lungs, with more or less definite outlines, which are quite characteristic of metastases.

This usual picture is, of course, easy to recognize, but the most important element in the syndrome, however, is the scar of the operation or the history of the presence of the primary lesion. At times, however, the clinical picture of the secondary metastasis occurs so early in the course of the disease that it entirely masks the primary lesion as the following case indicates:

About a year ago a middle-aged woman was admitted on our medical service at the Lenox Hill Hospital complaining of severe pain, cyanosis, cough and expectoration. She had been treated about six months previous for heart disease, and for about four months before that for intractable neuritis of the left upper extremity because of severe pains extending along the left arm and forearm. The examination showed the dyspnea to be due to fluid in both chests, which was more extensive on the right side. The left border of the heart extended to about five and a half inches to the left of the median line, but there was no evidence of any lesion of the heart. The most striking point in the examination, however, was the presence of a small adherent nodule, about the size of a walnut, in the left breast, with large adherent nodes in the left axilla. Upon exploring the left chest with the needle the fluid was found to be bloody in character. The pathology in this case was therefore very apparent. The so-called neuritis was due to secondary metastatic nodes in the left axilla from a primary carcinoma of the breast. The dyspnea, cyanosis and pleural effusion were all the result of the lung metastases, and these signs resembling the classic picture of myocardial insufficiency, assumed the important role in the syndrome. We corroborated our clinical ideas by roentgenographic examination and when the patient died a few weeks after admission, by an autopsy.

Primary lung tumors are much less common than secondary ones. The tumors may be benign or malignant. We can dismiss the benign tumors of the lungs with a few words as most of them are only discovered at the autopsy table and they give no clinical manifestations whatever. Dermoid cysts, however, merit more attention because these are the only benign tumors that may give clinical manifestations. They usually occur in the mediastinum, behind the sternum, and may exist there for years without any clinical disturbance. When, however, the tumor grows in size the only evidence is that of pressure in the mediastinum: dyspnea, cyanosis, cough and expectoration, or symptoms of pressure on the sympathetic nerves, such as pupillary changes. A definite diagnosis can only be made when the tumor finally ulcerates into a bronchus and hair or sebaceous contents of the cyst are expectorated. A dermoid cyst in the thorax may also be suspected when, after years of constant observation, the mediastinal tumor may be shown to be present without making any progress. Recently we have had under observation a patient who had a cyst about the size of a child's head in the right thorax which evidently came from the diaphragm and grew so rapidly that it occupied the lower half of the chest, displacing the lung upward. This mass gave the signs of consolidation which persisted for months and which showed in the roentgenographic shadow with a well-defined outline. There was no evidence of free fluid in the pleural cavity and the diagnosis of a tumor was readily made, principally on the basis of the roentgenogram and just as readily removed:

The most common type of primary lung tumors are the malignant ones. In spite of the fact that they are considered to be comparatively uncommon, we believe they are much more frequent than we are in the habit of regarding them. The infrequency of these lesions is based upon autopsy statistics. Autopsy findings do not tell the whole truth, for the statistics are only of relative value. It is surprising to know that Dr. Sidney Yankauer in an extensive series of bronchoscopic examinations found that 12 per cent. of his cases had primary malignant tumors of the lungs, most of which were unsuspected. Pathologically, malignant tumors are of three types: carcinoma, sarcoma and endothelioma. The latter type of tumor is considered as a form of carcinoma or as an intermediate type between sarcoma and carcinoma. The carcinomata originate either at the pleural surface or at the hilus of the lungs; sarcomata usually begin at the hilus, while endotheliomata, which are very slow growing tumors, originate on the surface of the lungs. From the clinical standpoint the primary origin of the tumor is of great importance for the diagnosis of primary lung tumors, for the diagnosis must be made early and the primary location recognized. We therefore distinguish two clinical types of primary lung tumors: (*a*) Those that originate at the pleural surface, and (*b*) tumors that originate at the hilus of the lung and usually from a bronchus.

The early diagnosis of a primary lung tumor, which is the only useful diagnosis in these days of progressive thoracic surgery, cannot be made on one examination alone. The case must be studied for weeks or months at a time, as the progress of the case while under observation is of diagnostic importance. Besides, these tumors usually grow very slowly. The symptoms may be classified into three groups: (1) General symptoms; (2) symptoms of the pleural type; (3) symptoms of the hilus type.

The patient in whom we have a right to suspect a lung tumor usually comes to the physician complaining of cough, pain in the chest and dyspnea of long duration. It is quite evident that this syndrome does not suggest any definite lesion. These symptoms may be due to subacute bronchitis, pulmonary tuberculosis, cardiorenal disease or primary lung tumor, and with close study of these generic symptoms we may verify our supposition regarding this possible lesion. The cough is usually dry in the pleural type, while in the hilus type it may be accompanied by profuse, thick, purulent sputum and only occasionally by blood-tinged sputum. It is rare indeed to see the prune-juice sputum as described in text-books. The pain may resemble that of pleurisy or it may be substernal or supraclavicular. It does not necessarily have any relation to the primary site of the lesion. The dyspnea is a very important sign. Persistent and marked dyspnea, with a disproportion between the dyspnea and the physical signs, is an extremely suggestive sign of lung tumor. The patient may be suffering for months from cough, pain, dyspnea and expectoration, and these may be the only persistent physical signs with a small area of localized bronchitis and an inordinate amount of dyspnea. In such a patient, after we have eliminated tuberculosis by repeated and thorough physical examination, by repeated sputum examinations, by tuberculin tests and by a complement-fixation test for tuberculosis we must then make all efforts to eliminate a primary lung tumor.

The physical signs are the characteristics by which we may be able to differentiate the type of the tumor. The signs of the peripheral type are largely pleural. Occasionally there is a friction rub, but the most characteristic sign is the occurrence of one-sided pleural effusion. The size of the effusion is not an indication of the size of the primary tumor. I have seen a small mass, the size of a walnut, give repeated pleural effusions of 2000 c.c. The effusion is invariably one-sided and the character of the fluid may be hemorrhagic, but it need not necessarily be so. Only about 50 per cent. of pleural effusions produced by primary lung tumors are hemorrhagic in character. As a rule it is serous in type, with the characteristics of a transudate. Occasionally on centrifuging the fluid we may obtain the characteristic large, highly granular cells which are believed to be pathognomonic of lung tumors, but we have rarely been successful in finding them except in one case in which the diagnosis was made without them. Recently the technic devised by Dr. Mandlebaum of Mount Sinai Hospital has made it easier to find these cells in the centrifuged fluid as well as in the sputum. Dr. Mandlebaum's method consists in embedding the centrifuged material in paraffin and then making serial sections. We have seen a chylous effusion in a case of primary lung tumor originating at the left apex of the lung, which was probably due to pressure on the thoracic duct. Of course, a pleural effusion may be just as suggestive of pulmonary tuberculosis, but the frequent recurrence of the fluid on the same side, especially when tuberculosis has been eliminated and when the fluid is bloody in character, is particularly suggestive of lung tumor.

Even when the pleural effusion is not present we may be able to diagnose a primary lung tumor by the localized bronchitis, with pain and inordinate dyspnea. When the tumor is large enough we may be able to make out a small area of consolidation on physical examination. Of course, if the case is followed long enough we may get all the signs of metastases: enlargement of the mediastinal area of dulness, glands, cachexia, etc., but the patient is then beyond therapeutic aid.

The hilus type is much more common and presents an entirely different picture. . The patient suffers for weeks or months from what seems to be chronic bronchitis, and usually tuberculosis can be definitely ruled out. The sputum may be mucoid or purulent and only later does it become prune-juice in color. If the tumor begins near a bronchus the findings may be only those of a localized bronchitis, with consolidation later on. Usually in the hilus type the signs are those of severe dyspnea, with signs of compression of a large bronchus, such as diminished breathing on auscultatory percussion and later on actual dulness and diminished breathing. It would seem, however, from the study of pathologic specimens of primary lung tumors, that we should get signs of massive consolidation. This is masked by the fluid, and when the fluid is removed we may get the signs of consolidation. But when these signs are present there is usually no diagnostic difficulty.

The hilus type of primary malignant tumor grows much more rapidly than the pleural type. The proximity of the tumor to the mediastinum is the reason for the occurrence, very early in the disease of pressure symptoms and metastases. The most common pressure symptoms are those of recurrent laryngeal paralysis, a one-sided dilated pupil from paresis, and finally paralysis of the sympathetic nerves; dilated veins over the sternum and local edema of the infraclavicular region; palpable left supraclavicular lymph nodes and finally enlarged axillary nodes, and increased areas of mediastinal dulness with myocardial insufficiency from pressure. Cachexia, which is a classic characteristic of the mediastinal type of malignant tumors and of malignant growths in other parts of the body, is absent in primary lung tumors until very late in the disease, and this symptom is therefore of little value for an early diagnosis.

The examination of the chest fluid holds out a helping hand, but unfortunately the grasp is not a very tight one. When we are most in need of aid it is usually of no value. When the diagnosis is evident these examinations are of corroborative help.

The characteristics of a typical specimen are only present in those cases with extensive involvement of the lung or of a hilus type which has perforated into the lumen of a bronchus. At first the sputum is not characteristic, but later on it may be found tinged with blood and still later it may resemble prune-juice, which is not due to the presence of blood and occasionally it has a characteristic greenish hue. Rarely we may find on microscopic examination proof of the tumor itself. Large polyhedral granules with faint vacuoles are believed to be almost pathognomonic, but they are rarely found when most needed. Centrifuging the fluid may bring out the characteristic granular cells, but this is rather a rare find. Dr. Mandlebaum, of Mount Sinai Hospital, has been able to find these cells more frequently by embedding centrifuged specimens in paraffin and making sections of them. It must be remembered, however, that sputum examinations are not of very great value. The finding of a few characteristic cells may be just enough diagnostic evidence to tip the scales in favor of a primary lung tumor. The diagnosis of a pleural effusion is usually not of great value. A hemorrhagic effusion is only indirect evidence of a malignant mass. Occasionally the lung puncture and examination of the aspirated material may show the tumor cells.

The nature of the tumor can only be surmised. The pleural type is more likely to be endothelial and then carcinomatous, while of the hilus type the most common tumor is usually sarcoma and less frequently carcinoma.

Examination of pathologic specimens of primary lung tumors seem to indicate that these masses show definite shadows on roentgenographic examination. Extensive involvement of the lungs by malignant tumor certainly does show very interesting pictures. But the condition is then quite advanced and the roentgenographic evidence is then merely corroborative. In early cases the roentgenogram does not show the definite evidence that we usually lack and that we are inclined to expect. The roentgenographic shadows of the lungs showing the primary lung tumors occur very late. We have watched two cases over a year before the roentgenogram showed a definite shadow in the lung. A mass in the mediastinum shows much more clearly and earlier than one in the pleura. Consequently when these shadows occur it is difficult to ascertain the primary lesion by study of the roentgenographic pictures. We had a man under observation about two years ago who gave a definite picture of primary lung tumor with metastases. The roentgenogram showed the mass in the mediastinum but no mass in the lung. Seven or eight plates were taken but none showed the mass in the lung, which we believed to be the primary tumor. At postmortem examination it was shown that we were correct in assuming the primary lesion to be in the lung and the secondary metastasis in the mediastinum, although the mediastinal shadows showed much earlier and more definitely than those in the lung. The recent method of roentgenographic examination after inflation with oxygen, devised by Drs. Stewart and Stein, is exceedingly helpful, in the roentgenographic study of primary lung tumor. By this method we may show masses in the lung much earlier than by the ordinary method. A case recently under our observation illustrates the advantage of this method. The patient had several pleural effusions in the chest in the course of a year and a half, several of which were bloody. Fourteen roentgenograms showed normal lung markings. We finally inflated the chest with oxygen after removing the fluid and the roentgenogram showed a definite mass about the size of a walnut at the right base on the pleural surface, which was corroborated at operation. We believe this was one of the first cases in which this method was used for the determination of a primary lung tumor. The mass was verified at operation and a lobectomy of the lung was successfully performed.

In the hilus type of tumor bronchoscopic examination is of distinct value. We believe in cases in which primary lung lesion is suggestive a bronchoscopic examination should always be done. In competent hands this method gives more evidence than any other and is practically devoid of danger. Even in cases of chronic bronchitis where tuberculosis can be ruled out we believe bronchoscopy is indicated.

The value of bronchoscopy was never brought out so forcibly as several years ago, in a patient, on the surgical service at the Lenox Hill Hospital, who suffered apparently from bronchiectasis, for which she was operated upon a number of times in the course of two or three years. She would have periodic attacks of coughing, with profuse expectoration. Repeated operations during her stay in the hospital were without avail.

When she died an autopsy revealed a pedunculated benign adenoma which acted like a ball valve, causing interrupted obstruction of the bronchial tree, with retention of secretion. When the secretion had accumulated an attack was brought on and the coughing kept up until the fluid was expectorated, with relief of the symptoms for a few days. The mass found at autopsy could readily have been seen and just as readily removed through the bronchoscope.

The definite diagnosis of primary lung tumor depends upon the clinical findings. When the principal findings are those of mediastinal symptoms and a mediastinal mass the differential diagnosis is between different types of mediastinal tumors, mediastinal Hodgkin's disease and aortic aneurysm. The differential diagnosis between other types of mediastinal tumors and Hodgkin's disease cannot be made on any difference in the clinical features in the lungs. Mediastinal Hodgkin's disease can only be recognized by the presence of other glandular enlargements and the characteristic blood picture and morphological picture of a removed gland. Aortic aneurysm can be differentiated by the clinical picture, the positive Wassermann and the pulsating mass on fluoroscopic examination.

In the pleural type and in the type where there is no evidence of a mediastinal mass the difference lies between a tumor and pulmonary tuberculosis. Pulmonary tuberculosis can be ruled out by careful and repeated negative sputum examinations, by the absence of cachexia, by the negative tuberculin reaction, by the negative complement-fixation test and by the finding of a tuberculous lesion.. Tuberculosis usually occurs in the upper part of the lung and travels downward, while primary lung tumors are much more liable to begin at the base of the lung. Fever and night-sweats may occur in both conditions with equal frequency. Not infrequently a primary lung tumor begins with evidence of primary infection, as the following case indicates. A young woman, aged about thirty-six years, was admitted to our medical service of the Lenox Hill Hospital with a lobar pneumonia. She had been ill for several weeks with a condition that began with sharp pain in the right side of the chest, dyspnea, high temperature which ran the course of a classic lobar pneumonia with consolidation. But the temperature never subsided nor did the consolidation ever clear up.

Repeated examinations of the sputum and complement-fixation tests for tuberculosis gave no evidence of tuberculosis. Repeated chest punctures gave no signs of fluid. Finally after about five or six weeks' observation with persistent temperature and apparently an unresolved pneumonia we obtained a clear serous fluid from the right chest, and we began to be suspicious that the lesion was a lung tumor. On taking a very careful history again it was brought out that about two years before the patient had a small nodule, the size of a walnut, removed from the left breast. We communicated with the surgeon who operated upon her and the pathologist who examined the mass and were told the mass proved to be a benign tumor. In a few weeks skin metastases and liver, abdominal and general metastases occurred, and the etiology of the condition was clear. The so-called pneumonia was evidently a pulmonary metastasis from a malignant tumor of the breast.

In spite of the apparently clear distinction between pulmonary tuberculosis and primary lung tumor the diagnosis of an early primary lung tumor is extremely difficult to make, and in doubtful cases an exploratory thoracotomy should be done. The tumor is then within the scope of modern surgery, and if the tumor proves to be a pleural one it can rapidly be removed with success.

The following case will illustrate the difficulty of differential diagnosis:

A man, aged about fifty-five years, was admitted to our service at the Lenox Hill Hospital with a one-sided pleural effusion which was of a serous character. Tuberculosis was definitely ruled out by repeated negative sputum examinations, by repeated negative tuberculin tests, by negative physical signs and numerous examinations and by negative complement-fixation test. We observed this man for about a year and a half, examining him repeatedly for tuberculosis and primary lung tumor. About fourteen roentgenograms were taken in the course of a year, all of which were negative, although he was aspirated a number of times, only two pleural effusions were bloody in character. After careful study we made the diagnosis of a primary malignant tumor of the lung which we finally demonstrated after oxygen inflation by the Stein and Stewart method to be about the size of a walnut. An exploratory thoracotomy showed the mass at the base just as we had proved clinically. It seemed to be a malignant tumor the size of a walnut and a lobectomy of the lower lobe of the right lung was done by Dr. Franz Torek. The patient made a stormy recovery and finally died about seven months later of chronic nephritis. The tumor turned out to be a cartilaginous tuberculous mass.

Conclusion.—The diagnosis of a primary lung tumor is one of the most difficult pulmonary lesions to recognize early. This can only be done with a fair degree of certainty. If we wait until we can do so positively the patient is beyond our therapeutic reach. Consequently when the condition cannot be recognized definitely an exploratory thoracotomy should be performed whenever there is a reasonable suspicion of a primary tumor of the lung. If such a lesion is present it can be removed at the time when the operative risk is at a minimum and the chances for recovery are at their height.

Clinically we may recognize two distinct types of primary lung tumor, the pleural and the hilus type. The pleural type is most amenable to surgical treatment.

A reasonable suspicion of the presence of the pleural type of primary lung tumor is based upon the occurrence of a one-sided pleural effusion, with or without bloody fluid, in the absence of definite signs of tuberculosis. The roentgenograms of the chest taken when the pleural cavity is inflated after removing the fluid is one of the best methods to demonstrate the mass in the lungs.

The hilus type is not so amenable to treatment, and the most important indications of its presence are the persistence of chronic bronchitis in the absence of tuberculosis, with evidence of blood-tinged sputum and the subsequent evidence of a mediastinal mass with pressure symptoms. In these cases bronchoscopic examination is of the greatest diagnostic value and gives the earliest evidence.

Finally, I believe that careful study of many cases of recurrent pleurisy and chronic bronchitis will reveal that primary lung tumors are much more common than we have heretofore believed.

INTUBATION AND VISUALIZATION OF THE DUODENUM IN SUSPECTED LESIONS OF THE PYLORUS, DUODENUM, AND GALL-BLADDER.

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The technic and the diagnostic significance of this procedure were described previously.[1] Its purpose is to determine whether defective filling and distortion at pylorus and the first part of the duodenum, is due to ulcer, pericholecystic adhesions, pressure from neighboring organs or caused reflexly from the intestines or other abdominal organs. From the writings of Smithies,[2] Carman[3] and Cole[4] it appears that this differentiation is not always possible. The experience of Lockwood is of interest. He states:[5] "Over four-fifths of duodenal ulcers that I have seen

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[1] Jour. Am. Med. Assn., December 4, 1920. Med. Rec., April 18, 1914.

[2] Jour. Am. Med. Assn., November 30, 1918.

[3] Ibid., March 28, 1914.

[4] Lancet, May 2, 1914.

[5] New York State Med. Jour., December, 1917.